

CHAPTER

31

STUDY GUIDE FOR CONTENT MASTERY

Galaxies and the Universe

SECTION 31.1 The Milky Way Galaxy

In your textbook, read about discovering the Milky Way.

For each item in Column A, write the letter of the matching item in Column B.

Column A

Column B

- | | |
|---|-----------------------|
| _____ 1. Stars in the giant branch of the H-R diagram that pulsate in brightness because of the expansion and contraction of their layers | a. Cepheid variables |
| _____ 2. Stars that have periods of pulsations between 1.5 hours and 1 day, and on average, have the same luminosity | b. luminosity |
| _____ 3. Stars with pulsation periods between 1 day and more than 100 days | c. RR Lyrae variables |
| _____ 4. By measuring a star's period of pulsation, astronomers can determine this. | d. Sagittarius |
| _____ 5. Direction of the center of the Milky Way is toward this constellation. | e. variable stars |

In your textbook, read about the shape of the Milky Way.

For each statement below, write *true* or *false*.

- _____ 6. Radio waves are used to map the Milky Way because they can penetrate the interstellar gas and dust without being scattered or absorbed.
- _____ 7. The Milky Way's galactic nucleus is surrounded by a nuclear bulge that sticks out of the galactic disk.
- _____ 8. Measurements of star luminosity at different distances provide a hint of the Milky Way's spiral arms.
- _____ 9. Around the Milky Way's nuclear bulge and disk is the halo, where the globular clusters are located.
- _____ 10. Astronomers mapped the emission wavelength of nitrogen gas in space to conclusively determine the existence of spiral arms in the Milky Way.
- _____ 11. Five major spiral arms and a few minor arms were identified in the Milky Way.
- _____ 12. The Sun is located in the Milky Way's minor arm Orion at a distance of 28 000 ly from the galactic center.
- _____ 13. In its 4.5-billion-year life, the Sun has orbited the galaxy approximately 100 times.

SECTION 31.1 *The Milky Way Galaxy, continued*

In your textbook, read about the mass of the Milky Way.

Use each of the terms below just once to complete the passage.

2.6 million

100 billion

center

dark matter

galaxy

gas clouds

stellar remnants

halo

supermassive black hole

The mass located within the circle of the Sun's orbit through the galaxy is about

(14) _____ times the mass of the Sun. Because the Sun is of average mass, astronomers have concluded there are about 100 billion stars within the disk of the (15) _____.

Astronomers have found evidence that much more mass exists in the outer galaxy. The stars and (16) _____ that orbit in the outer disk are moving faster than they would if the galaxy's mass were concentrated near the (17) _____ of the disk. Evidence indicates that as much as 90 percent of the galaxy's mass is contained in the (18) _____. This mass is not observed in the form of normal stars, and astronomers hypothesize that some of this unseen matter is in the form of dim (19) _____, such as white dwarfs, neutron stars, and black holes. The remainder of this mass, usually called (20) _____, is a mystery.

Studies of the motion of stars that orbit close to Sagittarius A* indicate that this area has about (21) _____ times the mass of the Sun, but is smaller than our solar system. Astronomers believe that Sagittarius A* is a (22) _____ that glows brightly because of the hot gas surrounding it and spiraling into it.

SECTION 31.1 *The Milky Way Galaxy, continued*

In your text, read about stellar distribution in the Milky Way.

Use the terms below to label the diagram. Each term may be used more than once.

disk

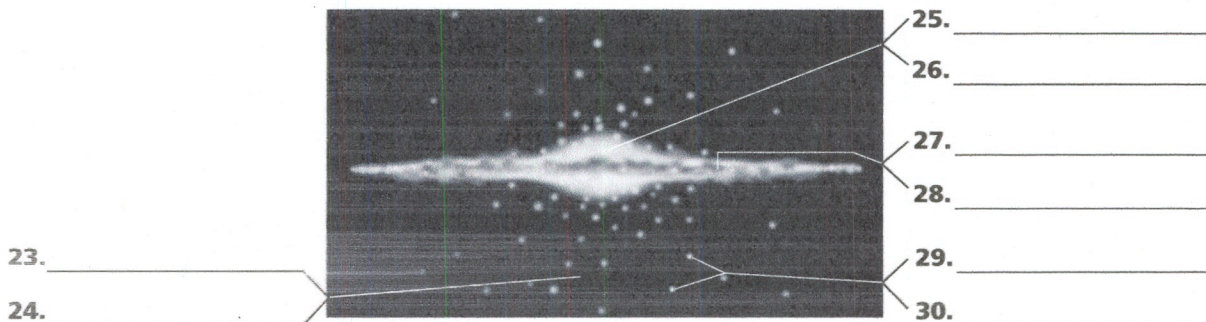
globular cluster

halo

nuclear bulge

Population I

Population II



Answer the following questions.

31. What are Population I stars? How do they differ from Population II stars?

32. Where does most star formation take place?

In your textbook, read about the formation and evolution of the Milky Way and maintaining spiral arms.

Answer the following questions.

33. What does the type of stars found in the halo and bulge indicate?

34. What two theories explain how the spiral arms are maintained?

CHAPTER**31****STUDY GUIDE FOR CONTENT MASTERY****SECTION 31.2 Other Galaxies in the Universe**

In your textbook, read about discovering other galaxies.

Circle the letter of the choice that best completes the statement or answers the question.

- The question about other objects existing in the sky was answered by Edwin Hubble in 1924. What did he discover in the Great Nebula in the Andromeda constellation?
 - Cepheid variable stars
 - a supernova
 - RR Lyrae variables
 - a black hole
- Disklike galaxies with spiral arms are divided into which of the following two subclasses?
 - normal spirals and flat spirals
 - normal spirals and barred spirals
 - flat spirals and barred spirals
 - loose spirals and flat spirals
- Galaxies that are not flattened into disks and do not have spiral arms are called
 - dwarf galaxies.
 - barred elliptical galaxies.
 - elliptical galaxies.
 - nebular galaxies.
- Galaxies that do not fit into the spiral or elliptical classifications are called
 - dwarf galaxies.
 - Hubble galaxies.
 - barred galaxies.
 - irregular galaxies.

In your textbook, read about groups and clusters of galaxies.

For each statement, write true or false.

- _____ 5. Most galaxies are spread evenly throughout the universe.
- _____ 6. The Milky Way belongs to a small cluster of galaxies called the Local Group.
- _____ 7. The Milky Way and the Andromeda Galaxy are two of the smallest members of the Local Group.
- _____ 8. When galaxies move away from each other, they form strangely shaped galaxies or galaxies with more than one nucleus.
- _____ 9. Studies of clusters of galaxies provide astronomers with the strongest evidence that most of the matter in the universe is visible and accounted for.

In your textbook, read about the expanding universe, active galaxies, and quasars.

For each item in Column A, write the letter of the matching item in Column B.

Column A

- _____ 10. Feature in the spectra of galaxies that indicates that they are moving away from Earth
- _____ 11. About 70 km per second per megaparsec
- _____ 12. Extremely bright galaxies that are often giant elliptical galaxies emitting as much or more energy in radio wavelengths than in wavelengths of visible light
- _____ 13. Starlike objects with emission lines in their spectra
- _____ 14. Provide important clues for astronomers to study the origin and evolution of the universe

Column B

- active galactic nuclei
- Hubble constant
- quasars
- radio galaxies
- redshift

SECTION 31.3 *Cosmology*

In your textbook, read about models of the universe.

Use each of the terms below just once to complete the passage.

2.735 K	background noise	Big Bang	<i>Cosmic Background Explorer</i>
compressed	radiation	Doppler	cosmic background radiation
cosmology	density	expanding	matter
			steady-state

The study of the universe, including its current nature, its origin, and its evolution is called **(1)** _____. The fact that the universe is **(2)** _____ implies that it had a beginning. The theory that the universe began as a point and has been expanding ever since is called the **(3)** _____ theory. Not all astronomers agree that the universe had a beginning. The **(4)** _____ theory proposes that the universe looks the same on large scales to all observers and that it has always looked that way. Supporters of this theory propose that new **(5)** _____ is created and added to the universe. Therefore, the overall **(6)** _____ of the universe doesn't change.

According to the more accepted theory, the Big Bang Theory, if the universe began in a highly **(7)** _____ state, it would have been very hot, and the high temperatures would have filled it with **(8)** _____. As the universe expanded and cooled, the radiation would have been shifted by the **(9)** _____ effect to lower energies and longer wavelengths. In 1965, scientists discovered a persistent **(10)** _____ in their radio antenna. The noise was caused by weak radiation called the **(11)** _____. It appeared to come from all directions in space and corresponded to an emitting object having a temperature of about **(12)** _____, which is close to the temperature predicted by the Big Bang theory. An orbiting observatory called the **(13)** _____, launched in 1989, mapped the radiation in detail.

SECTION 4

Reinforcement

Galaxies and the Universe

Directions: Use the terms below to complete the following sentences.

Milky Way	200 billion stars	Andromeda
Local Group	Steady state theory	galaxy
Doppler shift	Big Bang theory	cluster
elliptical	Clouds of Magellan	irregular
		spiral
		Oscillating model

- The two types of _____ galaxies are barred and normal.
- A _____ is a group of galaxies.
- _____ galaxies have many different shapes and are usually smaller and less common than other types of galaxies.
- A spiral galaxy about 2.2 million light-years away is in the constellation of _____.
- Galaxies shaped like footballs are _____ galaxies.
- Two irregular galaxies called the _____ orbit the Milky Way.
- A _____ is a large group of stars, gas, and dust held together by gravity.
- The _____ is an explanation for the formation of the universe.
- The solar system in which we live is in the _____ Galaxy.
- The Milky Way Galaxy contains more than _____.
- The Andromeda Galaxy is a member of the _____.
- The _____ causes changes in the light coming from distant stars and galaxies.
- One model of the origin of the universe is the _____, which proposes that the universe was always as it is now.
- Another model of the origin of the universe is the _____, which believes that the universe expands and contracts in a regular pattern.